

# The Relationship Between Industrial Concentration, Firm Size, and Technological Innovation

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## Purpose of the Study

The purpose of the study was to examine the relationships that exist between innovating firms, the industry to which they belong, and the environment in which they operate, with special emphasis on firm size.

## Background

This research was initiated to further the understanding of the process of innovation to give those seeking to stimulate innovative activity facts for policymaking.

One hypothesis is that large firms are better able to innovate because of their larger pool of financial resources. Conversely, those who believe a small firm environment favors innovation would argue that increasing firm size leads to inertia and slows the desire to innovate.

Shifting the argument from firm size to industry concentration, one theory is that highly concentrated industries should be more willing to innovate. The market power of firms in concentrated industries allows them to attain higher profit levels which could result in internal funds to invest in relatively risky R&D. Other arguments to support this view are that companies not subject to short-run uncertainties of competition may be more willing to commit funds to long-run R&D; that firms with greater market power may be more able to use the results of innovation through their extensive distribution and marketing channels; and that firms that do not compete on a price basis may be more interested in product differentiation and innovation.

The opposite argument is that firms in highly competitive industries have a greater incentive to innovate because of the competition. A hypothesis that follows from this view is that firms with high market power will innovate more slowly but may be aggressive followers or imitators of smaller firms who have completed the innovative process.

## Methodology

This study examined in detail actual innovations brought to market as opposed to many previous studies which used patented innovations or R&D expenditures as measures of innovative activity.

A sample of innovative products was compiled from technology and engineering publications issued between 1970 and 1979, and was supplemented with data on 45 innovations introduced after 1969, from an earlier study made by the contractor for the National Science Foundation, to give a total sample of 635 innovative products.

The publications covered three relatively concentrated industries: SIC 357—Office, Computing and Accounting Machines; SIC 371—Motor Vehicles and Motor Vehicle Equipment; and SIC 386—Photographic Equipment and Supplies.

The four relatively more competitive industries covered by the publications were SIC 307—Miscellaneous Plastic Products; SIC 354—Metalworking Machinery and Equipment; SIC 355—Special Industry Machinery, except Metalworking Machinery; and SIC 383—Optical Instruments and Lenses.

The sample of innovations that resulted from this selection process represented a broader range of products than the seven areas originally chosen for emphasis, which accounted for 209 of the 635 innovations.

Telephone inquiries and mailed questionnaires were used to obtain detailed data from innovative companies on a subset of the sample. Questions asked included: dates of key preproduction activities; dates of marketing activities including first retail sale; how the technology leading to the innovation was acquired; the role public funds played relative to the innovation; the size of the organization when the innovation was introduced; the organizational form of ownership when the innovation was introduced; and marketing information about the product and buyers. When these data were used to test a hypothesis, the maximum amount of data for the test was used.

Other data sources were used to develop statistical tests on the relationship between innovative behavior and the industry characteristics of concentration, capital intensity, and growth. Con-

centration was measured using the 4-firm concentration ratio by value of shipments for 4-digit SIC codes from the 1972 *Census of Manufactures of the Bureau of the Census*.

Capital intensity was measured by computing gross stocks per employee. Data for gross stocks, which are available only for 3-digit industries, were obtained from the capital stock data base of the Bureau of Labor Statistics. Comparable 3-digit SIC industry employment data were used in the calculations.

The annual growth rate for employment was calculated using employment data for 1967-76, or 1972-76 in industries where 1967 employment data were not available.

## Highlights

Small firms produce 2.5 times as many innovations as large firms relative to the number of people employed.

Small firms bring their innovations to market faster than large firms.

Large firms are 2.8 times more likely to be assisted in innovation by public funds.

Large firms in concentrated industries tend to acquire more of their innovations from other firms than do smaller companies.

Small firms in diffuse industries were less innovative than other small firms whether or not they were in a declining or growing industries group.

Small firms in slightly and moderately concentrated industries in the growing industries group were substantially above the group average for all small firms in innovations per employee.

Large firms in the growing industries group were more innovative than the average large firm in the group if they were in slightly to moderately concentrated industries.

The large firm rate of innovation in highly concentrated industries was below the average innovation rate for all large firms in the growing industries group.

Small and large firms exhibit substantially the

same distributions of innovation with respect to concentration ratio.

Innovation performance by small firms is not affected by capital intensity.

Large firms innovate less in capital-intensive industries than in industries that are not capital intensive.

With small firms producing significantly more innovations per employee, bringing these innovations to market faster, and being more efficient in their use of R&D dollars than large firms, public R&D funding of small technologically aware firms will be significantly more cost effective than the funding of larger firms.

## Implications of the Findings

The complete report is available from NTIS. Accession #PB82 226119; Cost: \$16.50; Microfiche cost: \$4.50.